Radiation Hard Monolithic SDRAM to Support DDR2 and DDR3 Architectures, Phase II

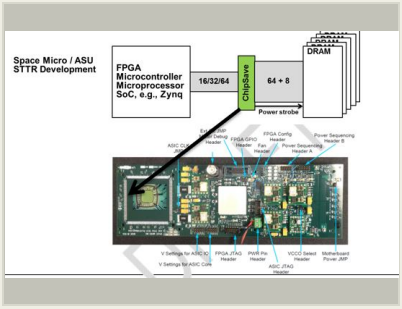
Completed Technology Project (2014 - 2020)

Project Introduction

Space Micro has developed the architecture for a radiation hardened memory subsystem that targets DDR3-and-beyond generations of DRAM. The architecture combines server platform error correction and memory buffer-on-board schemes with Space Micro proprietary techniques for radiation hardening and size, weight, and power reduction. During the NASA Phase I effort, Space Micro demonstrated two key elements of the architecture: (1) a scalable error correction coding (ECC) scheme that optimizes the robustness vs. efficiency vs. chip count tradespace, and (2) a Rad Hard By Design (RHBD) timing circuit for advanced DRAM fly-by routing. Space Micro has developed a Phase II plan for developing a server platform-like bridge chip that integrates ECC, interface logic, and timing circuitry into a high performance, low size, weight, and power (SWaP) memory subsystem suitable for next generation spacecraft computing.

Anticipated Benefits

Virtually all NASA space programs have a demand for this proposed technology and memory product. NASA applications range from science missions, space station, earth sensing missions e.g. (EOS), and deep space missions. NASA programs/missions that will benefit include new lunar landers and orbiters, Mars missions (MAVEN), solar system exploration e.g. (Titan, Juno, Europa, comet nucleus return, New Discovery, and Living with a Star (LWS). NASA programs which may continue to be funded by Congress include the Next generation heavy launch vehicle being developed out of NASA MSFC called SLS, the Orion Multipurpose Crew Exploration Vehicle (CEV), Commercial Crew Development Vehicle (CCDev2) and Commercial Orbiter Transportation Service (COTS) would benefit. Memory IC products evolving from this SBIR , and marketed by Space Micro, would have been enabling for NASA programs such as RBSP, GRAIL, LADEE, IRIS, Dawn, SDO, Aquarius, Kepler, Ocean Vector Winds, and space interferometry (SIR). New missions which hopefully will be funded include BARREL, CLARREO, GEMS, solar orbiter, solar probe plus, and ILN. Space Micro would be using these new memory devices in our next generation space communications SDR hardware such as that flown on the NASA GSFC IRIS program and the NASA Ames LADEE program, if the devices were qualified and available today.This cross cutting technology and evolving Space Micro memory products will also benefit many commercial space platforms, both LEO and GEO telecommunication satellites, including Intelsat, Direct TV, XM radio, Orbcomm, and Iridium Next telecom constellation replenishment, plus standard industry busses including Lockheed's A2100, and Boeing's HS-702. Civil earth sensing applications such as weather/metrology applications e.g. (NOAA GOES and Landsat) can also benefit. The large DoD space industry, including USAF, MDA, NRO, and new Army nanosat programs at SMDC will directly benefit. Among these programs are AEHF upgrades, GPS follow-ons, MDA's STSS and PTSS, USAF TacSat family, Plug and Play (PnP) sats, Operationally Responsive Space (ORS), and



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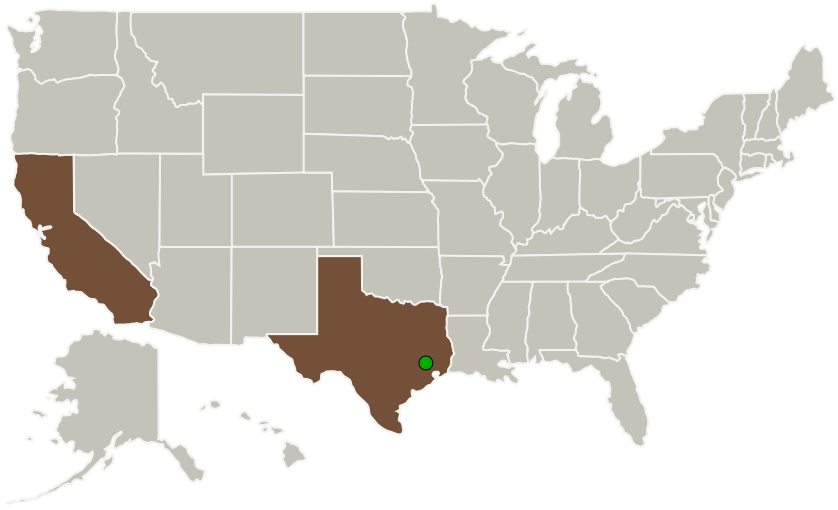
Army SMDC nanosat family. The entire CubeSat initiative including NRO's Colony program would benefit. Our memory product will also address emerging MDA radiation threats. These programs include CKV, AKV, THAAD, AEGIS, MKV, and GMD for Blocks 2017 and beyond. A specific example here is the Common Kill Vehicle (CKV) where the advanced interceptor needs dense SDRAM. With the new challenge of atmospheric neutrons to High Altitude Airship (HAA) programs and NASA or Air Force UAV programs, this memory product could be a timely solution. Other military applications may include strategic missiles (Trident and Air Force Minuteman and MX upgrades), as well as many DoD tactical weapon programs with nuclear survival levels.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Space Micro, Inc.	Lead Organization	Industry	San Diego, California
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Space Micro, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:

Charles R Bailey
Kathryn B Packard

Principal Investigator:

Bert R Vermeire

Co-Investigator:

Bert Vermeire

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Project Transitions

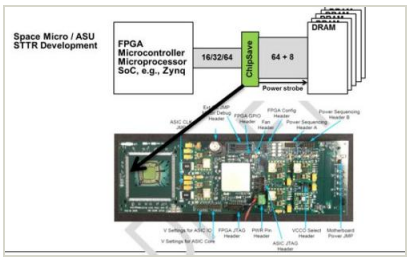
September 2014: Project Start

June 2017: Closed out

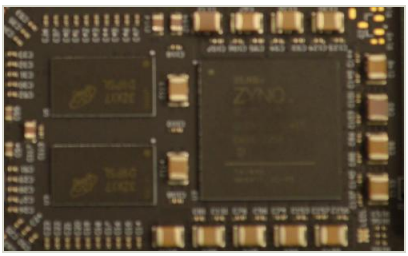
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137547)*

Images



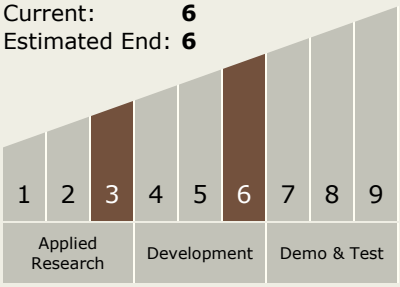
Briefing Chart Image
Radiation Hard Monolithic SDRAM to Support DDR2 and DDR3 Architectures, Phase II *(https://techport.nasa.gov/image/131604)*



Final Summary Chart Image
Radiation Hard Monolithic SDRAM to Support DDR2 and DDR3 Architectures, Phase II Project Image *(https://techport.nasa.gov/image/131222)*

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System